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ABSTRACT

Logical predictions about relationships between school aptitude and standardized achievement, aptitude and teachers' grades, and teachers' grades and standardized achievement can be made from the literature. These predictions are that (1) conventional school aptitude measures should predict standardized achievement test scores equally well for boys and girls but better for advantaged than disadvantaged children; (2) teachers' marks are more accurate for girls than for boys when judged against the sexes' standardized achievement test scores; are more accurate for middle-class than for disadvantaged children; and are least accurate for disadvantaged black males; and (3) teachers consistently give girls higher grades than boys but there are no important differences between boys' and girls' achievement when measured by standard achievement tests. The present study was conducted to test the strength of the relationships between pupil aptitude, standardized achievement and teachers' grades and to determine the percent of variance in grade point average accounted for by aptitude and standardized achievement in a representative sample of fifth- and ninth-grade Mexican-American, Black and Anglo students. (Author/RC)

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Relationships Between Teachers' Marks, Achievement Test Scores and Aptitude as a Function of Grade, Ethnicity and Sex

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Abstract

Logical predictions about relationships between (a) school aptitude and standardized achievement, (b) aptitude and teachers' grades and (c) teachers' grades and standardized achievement can be made from the literature. These predictions are that (a) conventional school aptitude measures should predict standardized achievement test scores equally well for boys and girls but better for advantaged than disadvantaged children; (b) teachers' marks are more accurate for girls than for boys when judged against the sexes' standardized achievement test scores; are most accurate for middle-class than for disadvantaged children; and are least accurate for disadvantaged black males; and (c) teachers consistently give girls higher grades than boys but there are no important differences between boys' and girls' achievement when measured by standard achievement tests. The present study was conducted to test the strength of the relationships between pupil aptitude, standardized achievement and teachers' grades and to determine the percent of variance in GPA accounted for by aptitude and standardized achievement in a representative sample of fifth- and ninth-grade Mexican-American, Black and Anglo students.

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Logical predictions about relationships between (a) school aptitude and standardized achievement, (b) aptitude and teachers' grades and (c) teachers' grades and standardized achievement can be made from the literature (see, for example, McCandless, 1970; McCandless, Roberts and Starnes, 1972). These predictions are that (a) conventional school aptitude measures should predict standardized achievement test scores equally well for boys and girls, but better for advantaged than disadvantaged children; (b) teachers' marks are more accurate for girls than for boys when judged against the sexes' standardized achievement test scores, are more accurate for middle-class than for disadvantaged children, and are least accurate for disadvantaged black males; and (c) teachers consistently give girls higher grades than boys even though there are no important differences between boys' and girls' achievement as measured by standardized achievement tests.

If these predictions are correct, certain teacher practices may be at least partially responsible for the difficulty that disadvantaged children experience in school by either increasing the rate at which this group rejects formal education or, alternatively, frustrating minority boys and girls in ways that result in scholastic inefficiency. The following study was conducted to test these predictions by measuring the strength of the relationships between pupil aptitude, standardized achievement and teachers' grades, and determining the percent of variance in teachers' grades accounted for by aptitude and standardized achievement in a representative sample of fifth- and ninth-grade Mexican-American, Black and Anglo students.

Methods

Subjects. The data reported were collected as part of a comparative research project involving eight nations sponsored by the U.S. Office of Education (Peck, 1974). Subjects for the present analyses were 321 fifth-grade and 347 ninth-grade Mexican-American, Black and Anglo students who were selected from 13 elementary and 4 junior high schools in Austin, Texas in the following manner. Approximately equal numbers of male and female students who were identified by their teachers as Anglo, Mexican-American or Black were randomly drawn from a pool of subjects in fifth- and ninth-grade classrooms. These subjects were then classified as to SES. SES classifications were based on an index which combined information on father's education and occupational status as provided by the student. The child's statements were scored on the six-point International Scale of Occupations (Havighurst, 1970), where "1" represented the highest status occupations (professional) and "6," the lowest (unskilled), on a "1" (university graduate) to "6" (some primary school) scale for level of education. Occupational status was believed to be a more predictive index of SES for the purposes of this study and, hence, was given a slightly greater weighting (1.33) than education when the combined index was calculated. Minority group Ss fell predominantly in the upper-lower class, while Anglo Ss fell predominantly in the lower-middle class. All Ss at other SES levels were eliminated from the following analyses.

Procedure. The Raven Progressive Matrices, 1956 revised form, was administered to both fifth- and ninth-grade Ss as a measure of general aptitude. The Raven was selected due to its nonverbal properties, which render it relatively "culture-fair." The Inter-American Series Test of

Reading was administered as a measure of reading achievement. The Elementary (Level 3) form was administered to fifth-graders and the Intermediate (Level 4) form to ninth-graders. The Metropolitan Achievement Test, Intermediate, Test 1 (Arithmetic Computation) was administered to fifth-grade Ss, and the UNESCO Institute for Education Math Test, Parts I-III and Problem 1 of Part IV, was administered to ninth-grade Ss. These scores were standardized within grades to a mean of 50 and a standard deviation of 10.

Grade point averages on a five-point system (A = 5.0) were computed for Ss based on the average of grades received in English (language arts), social studies, science, mathematics and foreign language.

The analysis strategy was to (1) determine the percent of unique variance in GPA accounted for by aptitude and standardized achievement for each of the 12 subgroups (sex x grade x ethnicity); (2) determine significant main and interaction effects for GPA for the three factors, adjusting GPA for differences in aptitude and standardized achievement test scores among the subgroups; and (3) determine the simple, unadjusted relationships between aptitude and achievement (reading and math) and between these variables and the criterion, GPA.

Results

1. Percent variance explained by aptitude and achievement. A comparison of the percent of variance in GPA accounted for by the three predictors (math achievement, reading achievement, and aptitude) for each subgroup indicates that substantially more of the variance in GPA was explained for Anglos than for minority group subjects. Table 1 shows the percent of variance accounted for by reading, math and IQ for each subgroup separately. The percent of variance accounted for by all three predictors was significantly different from zero for each of the subgroups. Prediction was poorest for fifth- and ninth-grade Black females, with 13% of the variance in GPA accounted for by

the three-predictor set, and best for fifth-grade Anglo males (47%) and ninth-grade Anglo females (46%).

Insert Table 1 about here

Table 1 also indicates the increase in percent of explained variance associated with the addition of each variable to a predictor set composed of the remaining two variables (i.e., the unique variance accounted for by each predictor). The most striking result is that when math achievement is added to the predictor set, predictive efficiency does not significantly increase for any of the fifth-grade subgroups or for half of the ninth-grade subgroups. The addition of math achievement enhances prediction only for ninth-grade Mexican-American females and for ninth-grade male and female Anglos.

For Black females, regardless of age, no variable, when added to the predictor set, significantly improved prediction. For Black males, only two predictors, reading achievement for fifth-grade Ss and aptitude for ninth-grade Ss, significantly improved prediction. This pattern is identical to that of Mexican-American males.

2. Main and interaction effects among subgroups (analysis of covariance). Results of an analysis of covariance indicated that when subjects were equated on all three covariables, significant main effects for sex, grade and ethnicity were found. These results are shown in Table 2. The direction of the sex effect was not surprising. It was as McCandless predicted: given boys and girls of equal ability and achievement, on the average, girls received higher GPA's than boys. It may be the case that this difference is due to differential grading by teachers. One can speculate that teachers

may have generally lower standards for females, such that an identical performance by a male and a female would result in a higher grade for the female, in which case relationships between GPA and standardized achievement would be higher for boys than for girls. Or, it may be the case that girls are more highly motivated to perform well in the classroom and, thus, may perform more in line with their standardized achievement scores.

Insert Table 2 about here

For the significant grade main effect, fifth-graders received higher GPA's, on the average, than ninth-graders. A significant Grade x Ethnicity interaction indicates that this difference for fifth- and ninth-graders is greater among Anglo Ss than among Ss of either minority.

The direction of the finding regarding the significant ethnicity main effect is somewhat surprising. Given Blacks, Mexican-Americans and Anglos of equal measured ability and achievement, expected mean GPA's are highest for Blacks, followed by Anglos and then Mexican-Americans. This order is reversed for the observed mean GPA's for these groups, suggesting that standardized math, reading and aptitude test scores which were statistically held constant in the above analysis accounted for the disparity between GPA's for Anglos and Mexican-Americans and, when GPA was adjusted on the basis of these variables, accounted for Blacks performing superiorly to Anglos and Mexican-Americans in the classroom. As only two variables (reading achievement and aptitude) were significant predictors for any of the Black subgroups, the joint effect of all three of the predictors could have accounted for this upward adjustment favoring Blacks. When considering the unique variance explained in GPA (Table 1), reading achievement when statistically controlled seems to have been most influential in the upward adjustment in GPA for Blacks, followed by aptitude, and then math achievement.

3. Correlations among predictors and criterion. Correlations between predictors and between predictors and criterion were calculated to test for the presence of differential teacher grading and differential pupil performance by sex and ethnicity. This analysis corresponds more closely with the data analysis strategy employed by McCandless (1972) and, thus, allows the opportunity to compare the present findings with those of this earlier study. These relationships are shown in Table 3. From these data, McCandless' first prediction, that aptitude measures predict standardized achievement test scores equally well for boys and for girls, was proven false. Contrary to expectations, the correlations between math achievement and aptitude were greater for females (mdn r = .396) than for males (mdn r = .296) for the six subgroups (grades five and nine for Anglos, Mexican-Americans and Blacks). This pattern held for the relationship between reading achievement and aptitude, where the median correlations were .502 for females and .289 for males.

Insert Table 3 about here

As might have been predicted by extending McCandless' SES expectations to ethnic groups, relationships between aptitude and achievement were generally higher for Anglos than for either of the two minority groups. Aptitude was a better predictor both for math achievement (mdn r = .472) and reading achievement (mdn r = .434) for Anglos than for either Mexican-Americans or Blacks, for whom median math and reading correlations were .328 (math) and .347 (reading), and .341 and .283, respectively.

As for the relationship between GPA and standardized achievement, McCandless' prediction was only partly replicated. Relationships between achievement and GPA revealed only a slight superiority for females over males with regard to reading achievement (mdn r = .443 for girls, .362 for boys), while the reverse was true with regard to math achievement (mdn r = .260 for girls, .315 for boys). The evidence indicates, however, that McCandless was correct in suggesting that relationships between GPA and achievement should be higher for middle-class than for lower-class pupils. This was borne out by relationships between GPA and standardized achievement, which were higher for the predominantly lower-middle-class Anglos in the sample (mdn r = .405 for math, .567 for reading) than for the predominantly upper-lower-class minority groups (mdn r = .260 for math, .296 for reading). However, it was the male Mexican-American, not the male Black, as McCandless predicted for whom relationships between standardized achievement and GPA were weakest.

As noted from the analysis of covariance (Table 2), McCandless' final prediction, that females receive higher classroom grades than males, was borne out when math and reading achievement test scores for these two groups were covaried. This prediction is confirmed by noting the size of the covariance adjustments made in GPA on the basis of achievement and aptitude. These adjustments were exceedingly small (male unadjusted = 3.49, adjusted = 3.50; and female unadjusted = 3.74, adjusted = 3.72) indicating that the observed differences in GPA probably cannot be attributed to relationships between GPA and achievement nor to GPA and aptitude.

McCandless, Roberts and Starnes (1972) have reported a similar attempt to validate logical predictions about relationships between teachers' marks, standardized achievement and aptitude. Rarely is the replication of ongoing

field research possible due to its cost and the political factors involved in conducting identical studies within the same school context. But, in the present instance our study is so closely matched in design and in sample to the McCandless, Roberts and Starnes study that it may well be considered a replication. In light of this, a comparison of these studies and a comment on the validity of McCandless' (1970) original predictions based upon both sets of data seem warranted.

1. Both the present study and that conducted by McCandless, Roberts and Starnes (1972) reported, contrary to expectations, that correlations between aptitude and standardized achievement were higher for girls than for boys. Thus, in these samples at least, girls seemed to have achieved more in line with their abilities than boys. Whether or not this result is due primarily to some yet unidentified feminine traits which lead girls to use their capacity to learn more than boys or whether such results are due primarily to the influence of the teacher, e.g., classroom climate, is yet unclear.

2. McCandless, Roberts and Starnes (1972), contrary to McCandless' (1970) own expectations, found that correlations between aptitude and standardized achievement were higher for disadvantaged than for advantaged students while the present study found the reverse. In the present study, aptitude and achievement had more variance in common among Anglo Ss than among subgroups of either minority. For disadvantaged or minority group students, factors other than aptitude, such as attention, motivation, conformity, rapport with teachers, etc., may have accounted for the generally poorer standardized achievement of this group when compared to Anglos. The two studies, therefore, report results in opposite directions, leaving us in a quandry with respect to this particular prediction. Differences perhaps might be resolved in part by examining the ways in which SES was measured in each study. In the McCandless, Roberts and Starnes study, the

disadvantaged or middle-class subjects attended five schools where fewer than 18% of the parent clientele had incomes below $3,000. Disadvantaged or lower social class subjects attended five different schools where more than 47% of the parent clientele had incomes lower than $3,000. The present study employed a combined occupational and educational index which, while taking into consideration parental income, did so at the pupil and not school level.

3. Both studies only partially supported the hypothesis that teachers' marks when judged against achievement test results will be more accurate for girls than for boys. In the present study this was true for reading achievement but not for math achievement, where the reverse was found. In the McCandless, Roberts and Starnes study 15% of the variance in teachers' marks for girls was accounted for by achievement (specific content area not reported) and for boys only 4%. Contrary to these results but in agreement with logical predictions, the present study found stronger relationships for predominantly lower-middle-class Anglos than for predominantly upper-lower-class minority students. While the earlier study accounted for 53% of the variance between teachers' marks and standardized achievement for a disadvantaged sample, only 1% of the variance in teachers' marks was explained by standardized achievement for advantaged pupils. In contrast, the present study reported that for advantaged students approximately 16 and 32 percent of the variance in GPA could be accounted for by math and reading achievement, respectively, and that for the disadvantaged sample approximately 7 and 9 percent of the variance in GPA could be accounted for by standardized achievement in these subjects, respectively.

4. Both the earlier study and the present one supported the prediction that, generally, girls receive higher classroom grades than boys. This

result was unequivocal in both studies and points to the conclusion that either variables other than aptitude and standardized achievement, e.g., motivation, rapport with teacher, conformity to teachers' standards, etc., are correlated with GPA more highly for females than for males, or alternative reasons must be posited for why teachers grade girls higher than boys, e.g., most elementary school teachers are female. Additional studies and replications are needed to answer this as well as other questions raised by the comparison of these two studies.

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Table 1. Percent of Variance in GPA Explained by Math Achievement, Reading Achievement and Aptitude.

Group	n	% Total Variance (R^2)	% Variance Math Achievement	% Variance Reading Achievement	% Variance Aptitude
5th gr. Black males	39	.2863**	2.45	13.16**	0.91
5th gr. Black females	38	.1325*	2.69	4.29	4.14
9th gr. Black males	40	.2471**	1.25	1.10	9.56*
9th gr. Black females	46	.1312*	1.34	4.64	0.00
5th gr. Mex.-Amer. males	35	.2821**	2.90	26.20**	0.00
5th gr. Mex.-Amer. females	37	.4021**	0.00	10.01*	7.74*
9th gr. Mex.-Amer. males	41	.3580**	0.57	5.07	8.44*
9th gr. Mex.-Amer. females	44	.2291**	8.30*	2.02	0.01
5th gr. Anglo males	87	.4700**	0.02	11.95**	11.39**
5th gr. Anglo females	85	.4545**	1.12	12.93**	4.78**
9th gr. Anglo males	89	.3797**	8.10**	3.73*	1.48
9th gr. Anglo females	87	.4602**	2.93*	7.69	0.11

*P < .05 **P < .01

Table 2. Percent of Variance in Adjusted GPA Explained by Sex, Grade and Ethnicity (Analysis of Covariance).

A Sex			B Grade			C Ethnicity			A x B			A x C			B x C		
Group	N	$\bar{X}$*	Group	N	$\bar{X}$	Group	N	$\bar{X}$	Group	N	$\bar{X}$	Group	N	$\bar{X}$	Group	N	$\bar{X}$
M	331	3.50	5	321	3.82	B	166	3.68	M-9	170	3.27	M-B	79	3.63	9-B	86	3.61
F	337	3.72	9	347	3.41	MA	157	3.56	F-9	177	3.56	F-B	84	3.85	9-MA	85	3.43
						A	348	3.57	M-5	163	3.70	M-MA	76	3.55	9-A	176	3.31
									F-5	160	3.92	F-MA	81	3.59	5-B	77	3.89
												M-A	176	3.42	5-MA	72	3.73
												F-A	172	3.73	5-A	172	3.84
F	21.40			61.70			4.25			1.23			2.54			3.03	
%	2.0			5.7			.79			.12			.48			.57	
p	.001			.001			.014			.267			.077			.047	

Note: for A x B x C, p = .233.
*adjusted for differences in aptitude and standardized achievement

Table 3. Intercorrelations Between GPA, Aptitude, and Standardized Achievement

Group	n	Aptitude/ Math Ach.	Aptitude/ Read. Ach.	Aptitude/ GPA	Math Ach./ GPA	Read. Ach./ GPA
5th gr. Black males	39	237	425**	528**	258	581**
5th gr. Black females	38	349*	423**	491**	159	630**
9th gr. Black males	40	595**	446**	448**	552**	465**
9th gr. Black females	46	658**	607**	497**	606**	616**
5th gr. Mex.-Amer. males	35	291*	262	-004	113	261
5th gr. Mex.-Amer. females	[illegible]	030	535**	560**	143	555**
9th gr. Mex.-Amer. males	41	365*	278*	415*	348*	367*
9th gr. Mex.-Amer. females	44	446**	417*	312*	423**	332*
5th gr. Anglo males	87	-069	301**	259**	308**	354**
5th gr. Anglo females	85	246*	266*	-142	294**	229*
9th gr. Anglo males	89	437**	260*	341**	322**	357**
9th gr. Anglo females	97	649**	481**	162	226*	240*

*p < .05 **p < .01